Docket No. BFGHP0210USA

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re **PATENT** application of:

Applicants:	Thomas R. Moreland & Kurt M. Tauscher
Application No.:	09/768,885
For:	ELECTRICALLY HEATED AIRCRAFT DEICER PANEL WITH STITCHED HEATER STRAND *(as amended)*
Filing Date:	January 23, 2001
Examiner:	John A. Jeffery
Art Unit:	3742

APPEAL BRIEF

Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Applicant submits this brief in connection with the appeal of the above-identified case.

I. Real Party in Interest

The real party in interest in the present appeal is THE B.F. GOODRICH COMPANY, the assignee of the present application.

II. Related Appeals and Interferences

Appellants, appellants' legal representatives, and/or the assignee of the present application are unaware of any appeals or interferences which will directly affect, which will be directly affected by, or which will have a bearing on the Board's decision in the pending appeal.

III. Status of Claims

Claims 1-32 are pending in the application, claims 1-12 and 24-28 are withdrawn from consideration, and claims 13-23 and 29-32 stand finally rejected and are the subject of this appeal.

IV. After-Final Actions

In a reply filed to the final Office Action, the specification was amended to reflect the addition of Figure 6, claims 1 and 13 were amended to address objections raised by the Examiner, and claim 13 was additionally amended to clarify that the joining layers need not be joined after the stitching step to overcome a restriction requirement. In an Advisory Action mailed on November 29, 2001, the Examiner indicated that the objections to the claims and disclosure had been overcome, but that the amendment to non-elected claim 13 would not be entered.[1]

III. Background of Invention Defined in the Claims on Appeal

An aircraft can be periodically exposed to conditions of precipitation and low temperatures which can cause the forming of ice on its wings and other exposed surfaces. If the aircraft is to perform sufficiently in flight, it is important that this ice be removed whereby deicers are usually installed on the aircraft. Of particular interest in the present appeal is an electrically heated aircraft deicer which typically comprises a deicing panel that is installed on the aircraft. For example, a panel can be secured to each of the aircraft's wings to prevent ice accumulation thereon.

A deicer panel will typically include an inner support layer, a heater layer, a thermal conducting layer, and an outer cover layer. An electrical heating element is attached to the heater layer, the layers are bonded together, and the inner support layer is cemented to the aircraft wing. In operation, the heating element is electrically

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1. The Examiner also stated in the Advisory Action that the "35 USC 112, second paragraph rejection is maintained." However, this "112" rejection was coached in terms of an objection in the final Office Action. In any event, the issues raised in this objection are hopefully resolved in the Amendment filed with this Appeal Brief.

heated, whereby heat is transmitted to the thermal conducting layer which uniformly distributes the heat to the outer cover layer to remove accumulated ice therefrom.

The heating element commonly comprises an electrically conductive wire that is attached to the heater layer in a heat-dissipating pattern. Typically, the heat-dissipating pattern comprises a winding path of closely spaced and sharply curved turns formed by a continuous length of wire. To attach the wire, the breezeside of the heater layer is coated with an adhesive and locating pins are placed in accordance with the desired pattern, for example, at the corners of each of the many turns of the coils. The electric wire is then wound around the locating pins and adhesively secured to the layer. In view of the complexity and closeness of most heat-dissipating patterns, placing of the locator pins and/or winding of the wire around the locator pins can be tedious and time-consuming tasks. Moreover, automation of these tasks has proved to be difficult.

IV. Summary of Invention Defined in the Claims on Appeal

The present invention provides an aircraft deicer panel which eliminates the need for adhesives, locating pins, and other inconveniences associated with conventional methods for forming wire patterns on the panel's heater layer. Additionally, the deicer panel of the present invention lends itself to automation.[2]

More particularly, the present invention provides a deicer panel 10 comprising an inner support layer 20, a wire-containing layer 22, a thermal conducting layer 24, an outer cover layer 26, and an electrical heating element 28 attached to the layer 22. The layers are bonded together and the inner support layer 20 is attached (*e.g.*, cemented) to the aircraft wing 14. In operation, the heating element 28 is electrically heated, whereby heat is transmitted to the thermal conducting layer 24 which uniformly distributes the heat to the cover layer 26 to remove accumulated ice therefrom. (See Figure 2, below, wherein the panel 10 is shown in a flat condition.)

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2. Specification, page 2, lines 11-14.

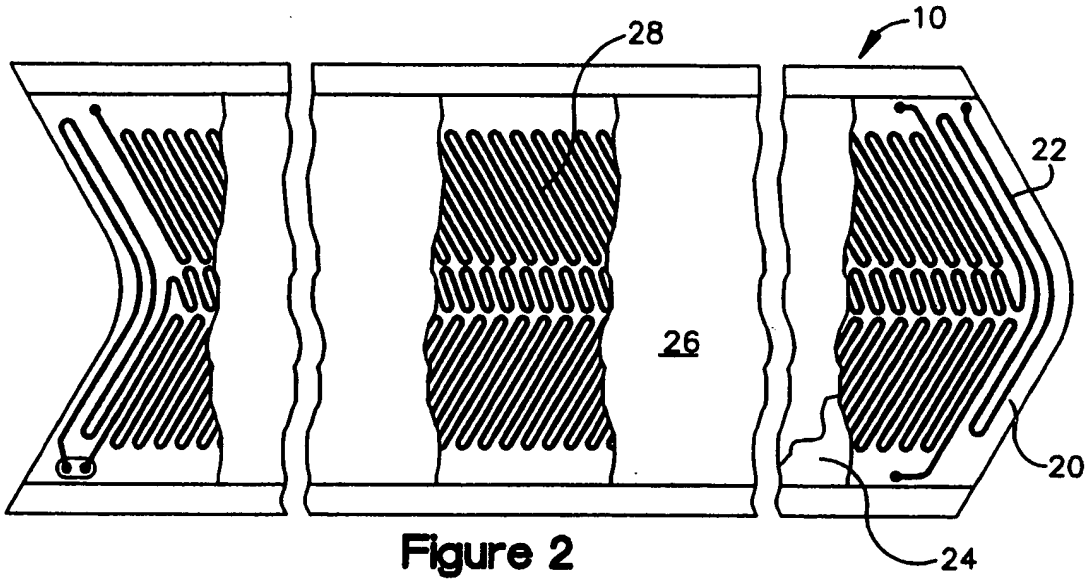

Figure 2

The inner support layer 20 is made of a material that provides electrical insulation between the heating elements 28 and the wing 14 (*e.g.*, rubber coated fiberglass fabric). The heater layer 22 is made of a material that provides an appropriate attachment medium for the heating element 28, that provides electrical insulation, and that provides a sufficient thermal conductivity to transfer the heat from the element 28 to the layer 24 (*e.g.*, cured rubber, fiberglass weaves, composite adhesives). The thermal conducting layer 24 is made of a material that provides electrical insulation but at the same time effectively diffuses and rapidly conducts heat from the heating element 28 to the outer cover layer 26 (*e.g.*, rubber coated fiberglass fabric). The cover layer 26 is made of a material that has a high thermal conductivity, that is resistant to abrasion/corrosion, and that is sufficiently stiff/strong for protective purposes (*e.g.*, sheet aluminum alloy, stainless steel, magnesium alloy).[3]

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3. Specification, page 4, lines 6-18.

The heating element 28 comprises an electrically conductive strand 30 which is stitched in the heating layer 22 in the heat-dissipating pattern.[4] The strand 30 is made of a suitable metal (*e.g.*, aluminum bronze alloy, nickel-chromium alloy, nickel-chromium-iron alloy, or nickel-copper alloy) which is flexible enough to accommodate to the sewing process.[5] (See Figures 3 and 4, below.)

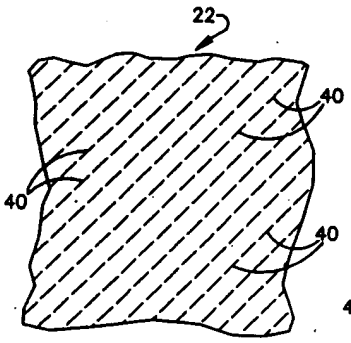

Figure 3

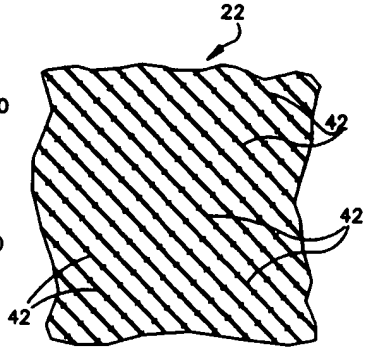

Figure 4

In the illustrated embodiment, the heating element 28 also comprises a dielectric strand 32 made of a suitable electrically non-conducting material (*e.g.*, nylon). On the breezeside of the heater layer 22 (*i.e.*, closest to the outer layer 26) the electrically conductive strand 30 forms a series of linear stitches 40. On the bondside of the heater layer 22 (*i.e.*, closest to the inner layer 20) the dielectric strand 32 forms a series of linear stitches 42.[6]

The heating element 28 can be formed on an industrial sewing machine 48 having a needle 50, a shuttle 52, and a throat plate 54. The electrically conductive strand 30 is carried by the needle 50 and the dielectric strand 32 is unreeled from a bobbin 56 carried in the shuttle 52. The descending needle 50 penetrates the layer 22

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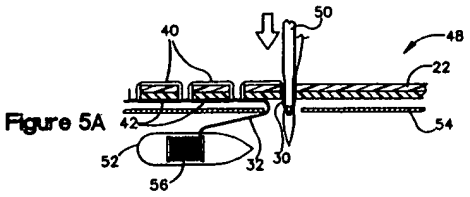
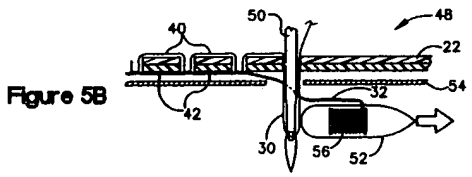
4. The heat-dissipating pattern of the heating element 28 comprises a winding path of closely spaced and sharply curved turns extending substantially the entire span of the panel 10.

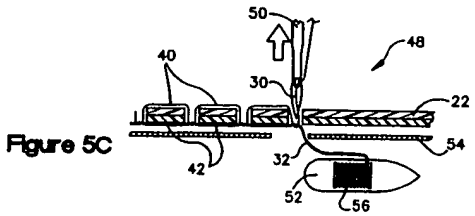
5. Specification, page 4, lines 19-26.

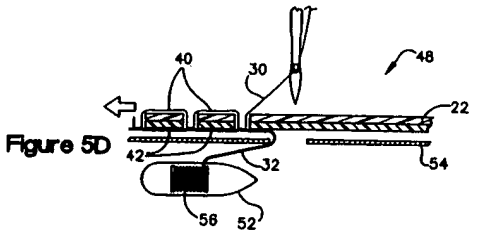
6. Specification, page 4, line 27 through page 5, line 2.

and carries the electrically conductive strand 30 along. When the needle 50 rises again, the strand 30 forms a loop on the underside of the layer 22. The shuttle 52 (which contains the bobbin 56 of the dielectric strand 32) goes through this loop and pulls the dielectric strand 32 along behind it. The dielectric strand 32 is thus enclosed in the loop of the electrically conductive strand 30. The layer 22 is then moved forward while the needle 50 remains stationary and the shuttle 52 returns to its initial position. This causes the slack loop to be pulled tight and close up, so that the two strands 30 and 32 interlock in the middle of the layer 22. When the forward movement of the layer 22 is completed, the process is repeated to form another stitch set 40/42.[7] (See Figures 5A- 5D, below.)









Accordingly, the present invention provides a deicer panel 10 and a method of making such a panel which eliminates the need for adhesives, locating pins, and other inconveniences associated with conventional methods for forming wire patterns on the heater layer. Also, industrial sewing machines are available with two-dimensional drives (see *e.g.*, U.S. Patent No. 5,809,918) which can be programed to automatically stitch the desired heat-dissipating pattern, whereby the present invention lends itself to automation.[8]

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7. Specification, page 5, lines 3-18.

8. Specification, page 5, lines 19-25.

V. Issues

A. Whether claims 13, 14 and 16-22 are patentable under 35 U.S.C. §103 over U.S. Patent No. 2,653,320 to Pfenninger in view of U.S. Patent No. 1,142,393 to Bloomer.

B. Whether claims 15 and 23 are patentable under 35 U.S.C. §103 over Pfenninger in view of Bloomer, and further in view of JP2000-106268.

C. Whether claims 29032 are patentable under 35 U.S.C. §103 over Pfenninger in view of Bloomer, and further in view of U.S. Patent No. 2,599,059 to Jones.

VI. Grouping of Claims

For the purposes of this appeal only, the claims stand or fall with each other, issue by issue.[9]

VII. Argument

For the following reasons, claims 13-23 and 29-32 are believed to be patentable over the applied art.

Issue A

Claims 13, 14 and 16-22 have been rejected as being obvious over U.S. Patent No. 2,653,320 to Pfenninger in view of U.S. Patent No. 1,142,393 to Bloomer.

The Examiner appears to admit that Pfenninger does not disclose stitched heating wire, but he contends that, in view of Bloomer, this would have been obvious "in order to provide a faster method of affixing the element as well as facilitating the use of a larger quantity of heating wire per unit area as compared with conventional wire mounting techniques." However, it is respectfully submitted that if wire density was an issue (and it very much is in aircraft deicers), the applied art would motivate one of ordinary skill in the art to stick with a non-stitched arrangement. Specifically, when the

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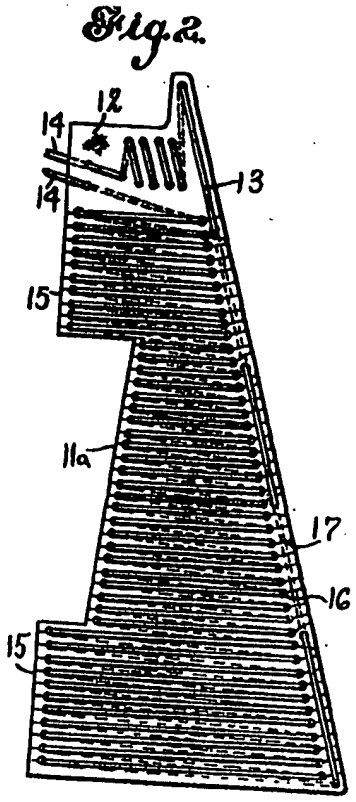
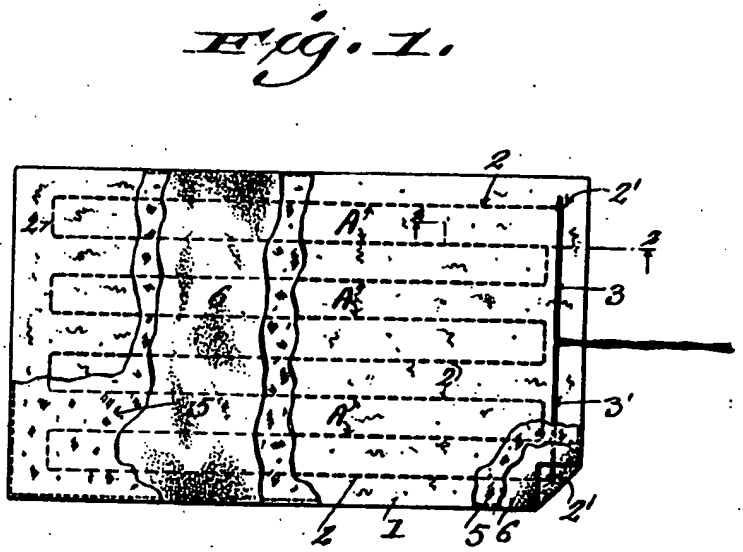
9. This grouping is conditioned upon the Examiner not entering any new grounds of rejection and/or any new points of argument.

Pfenninger non-stitched pattern (Figure 2, on the left below) is compared to the Bloomer stitched pattern (Figure 1, on the right below), it is the non-stitched pattern which appears to "facilitate the use of larger quantity of heating wire per unit area."





The Examiner acknowledges that "the meandering zig-zag pattern of Pfenninger is more densely spaced together than the sinuous pattern of Bloomer." He stresses, however, that his rejection does not rest on the premise that "Bloomer's sinuous pattern, taken in the longitudinal plane of the heater wire, used a larger quantity of heater wire per unit area." Instead, the Examiner states that the he "was merely suggesting that the attachment technique of stitching a heater wire to an underlying substrate, as opposed to other attachment techniques, provides the added benefit of providing more heater wire per unit area than if the heater wire were not stitched." To support this position, he points to the following passages in the Bloomer patent:

> [I]t is apparent that the resistance conductor so attached to the body of the pad will be quickly affixed thereto **with a maximum amount of surface or length of conductor in proportion to a minimum space**.
>
> [B]y employing the strand as a sewing element . . . [the pad's] utility and lasting qualities are proportionally greater, due to the fact that in stitching the strand **a greater number of feet of resistance conductor in a given length is obtained than in such pads wherein the conductor is laid thereon and secured in an ordinary manner**.[10]

The Examiner further explains that the Bloomer stitched heater pattern "involves not only configuring the heater in the plane of the underlying substrate, but also disposing the heater wire **transverse** to the plane of the underlying substrate." He further clarifies that:

> It is the **combination** of vertical **and** horizontal components of the heater wire itself which gives rise to the increased heater wire per unit area of the substrate. That is, for a given surface area, a stitched heater mounting, with its requisite horizontal and vertical heater path components **necessarily** requires more wire per unit area than a heater securement utilizing only a substantial horizontal component.

While the Examiner's conclusion regarding the "increased heater wire per unit area" may or may not be correct, it would in any event be inconsistent with deicer design. The purpose of a deicer panel is not to heat an entire airfoil structure, but rather to remove ice from its accumulated surface. Heating spaces vertically below the breezeside surface of the heater layer does little to forward this objective and, in fact, robs the deicing system of heating energy for melting ice. Accordingly, one of ordinary skill in the art would not be motivated to provide the sinuous Pfenninger pattern with "vertical components," as this would not increase the **deicing** heat per unit surface area.

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10. Page 1, lines 33-38 and lines 97-107, emphasis added by Examiner.

Accordingly, it is respectfully submitted that the Examiner's proposed Pfenninger/Bloomer combination would not have been obvious.

Issue B

Claims 15 and 23 have been rejected as being obvious over Pfenninger in view of Bloomer, and further in view of JP2000-106268. These claims depend from claim 13 and claim 16, respectively, and the added Japanese reference does nothing to cure the shortcomings of the proposed Pfenninger/Bloomer combination. Moreover, the Japanese reference offers absolutely no suggestion that a sewing machine should or could be programmed to automatically stitch a heat dissipating pattern for an aircraft deicer panel.

Issue C

Claims 29-32 have been rejected as being obvious over Pfenninger in view of Bloomer, and further in view of U.S. Patent No. 2,599,059 to Jones. These claims depend from claims 13 and 16, respectively. Whatever Jones teachings may be regarding cement, this reference does nothing to cure the shortcomings of the proposed Pfenninger/Bloomer combination.

VIII. Conclusion

In view of the foregoing, appellant respectfully submits that the claims are patentable over the applied art and that the final rejection should be reversed.

This brief is being submitted in triplicate along with a check in the amount of $320.00 to cover the fee for filing this brief in support of the appeal.[11]

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11. Should a petition for an Extension of Time be necessary for the timely filing of this brief (or if such a petition has been made and an additional extension is necessary), petition is hereby made and the Commissioner is authorized to charge any fees (including additional claim fees) to Deposit Account No. 18-0988, Order No. BFGHP0210USA.

Respectfully submitted,

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CERTIFICATE OF MAILING

I hereby certify that this paper (along with any paper or item referred to as being attached or enclosed) is being deposited with the United States Postal Service on the date shown below with sufficient postage as first-class mail in an envelope addressed to Assistant Commissioner for Patents, Washington, D.C. 20231.

Date: Feb. 27, 2002

Marian E. Vasquez

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1. An aircraft deicer panel comprising an inner support layer which is electrically insulating, an outer cover layer which is thermally conducting, a heater layer which is electrically insulating, and an electrical heating element attached to the heater layer;

wherein the electrical heating element comprises an electrically conductive strand stitched in the heater layer in a heat-dissipating pattern;

wherein the stitched heater layer is joined to the inner support surface and the and the outer cover layer; and

wherein the inner support layer has a bondside surface adapted to be secured an ice-susceptible surface of an aircraft.

2. A deicer panel as set forth in claim 1, wherein the heat-dissipating pattern comprises a winding path of closely spaced and sharply curved turns formed from a continuous length of the electrically conductive strand.

3. A deicer panel as set forth in claim 1, wherein the heater layer is made from cured rubber, fiberglass, or composite adhesive.

4. A deicer panel as set forth in claim 1, wherein the electrically conductive strand is made of aluminum bronze alloy, nickel-chromium alloy, nickel-chromium-iron alloy, or nickel-copper alloy.

5. A deicer panel as set forth in claim 1, wherein the electrical heating element further comprises a dielectric strand which is used to secure the electrically conductive strand in the heat-dissipating pattern.

6. A deicer panel as set forth in claim 1, wherein the electrically conductive strand forms a series of linear stitches on a breezeside of the heater layer.

7. A deicer panel as set forth in claim 6, wherein the electrical heating element further comprises a dielectric strand forming a series of linear stitches on a bondside of the heater layer.

8. A deicer panel as set forth in claim 7, wherein the electrically conductive strand and the dielectric strand interlock between adjacent stitches.

9. A deicer panel as set forth in claim 1, further comprising a thermal conducting layer which is electrically insulating and which is positioned between the heater layer and the outer cover layer.

10. In combination, an aircraft and a deicer panel as set forth in claim 1, the bondside surface of the inner support layer being cemented to the ice-susceptible surface of the aircraft.

11. A combination as set forth in claim 10, wherein the ice-susceptible surface is on a wing of the aircraft.

12. In combination, an aircraft and a deicer panel as set forth in claim 1 secured to each wing of the aircraft, the bondside surface of the inner support layer of each deicer pane being cemented to the respective wing.

13. A method of making the aircraft deicer panel of claim 1, said method comprising the steps of:

stitching the electrically conductive strand into the heater layer in the heating-dissipating pattern;

joining the heater layer to the inner support layer and the outer cover layer; and

securing a bondside surface of the inner support layer to a surface of an aircraft.

14. A method as set forth in claim 13, wherein said stitching step is performed by a sewing machine.

15. A method as set forth in claim 14, wherein said stitching step comprises programming the sewing machine to automatically stitch the heat dissipating pattern.

16. A method of making an aircraft deicer panel, comprising the steps of:

providing an inner support layer which is electrically insulating, an outer cover layer which is thermally conducting, and a heater layer which is electrically insulating;

stitching an electrically conductive strand in the heater layer in a heat-dissipating pattern;

joining the inner support layer, the heater layer, and the cover layer together; and

securing a bondside surface of the inner support layer to a surface of an aircraft.

17. A method as set forth in claim 16, further comprising the step of positioning a thermal conducting layer which is electrically insulating between the heater layer and the outer cover layer.

18. A method as set forth in claim 17, wherein said stitching step comprises stitching a winding path of closely spaced and sharply curved turns from a continuous length of the electrically conductive strand to form the heat-dissipating pattern.

19. A method as set forth in claim 18, wherein said stitching step comprises using a dielectric strand to secure the electrically conductive strand in the heat-dissipating pattern.

20. A method as set forth in claim 19, wherein said stitching step comprises forming a series of linear stitches on a breezeside of the heater layer with the electrically conductive strand.

21. A method as set forth in claim 20, wherein said stitching step comprises forming a series of linear stitches on a bondside of the heater layer with a dielectric strand.

22. A method as set forth in claim 21, wherein said stitching step comprises interlocking the electrically conductive strand with the dielectric strand to separate adjacent stitches.

23. A method as set forth in claim 16, wherein said stitching step comprises programming a sewing machine to automatically stitch the heat dissipating pattern.

24. A deicer panel as set forth in claim 1, wherein the inner support layer comprises a rubber-coated fabric.

25. A deicer panel as set forth in claim 24, wherein the outer cover layer is made from a material selected from a group consisting of sheet aluminum alloy, stainless steel and magnesium alloy.

26. A deicer panel set forth in claim 1, further comprising a thermal conducting layer positioned between the heater layer and the outer cover layer.

27. A deicer pane as set forth in claim 26, wherein the thermal conducting layer comprises a rubber-coated fiberglass fabric.

28. A deicer panel as set forth in claim 1, wherein the outer cover layer is made from a material selected from a group consisting of sheet aluminum alloy, stainless steel and magnesium alloy.

29. A method as set forth in claim 13, wherein said securing step comprises securing the bondside surface of the inner support layer to a wing of the aircraft.

30. A method as set forth in claim 13, wherein said securing step comprises cementing the bondside surface of the inner support layer to the surface of the aircraft.

31. A method as set forth in claim 16, wherein said securing step comprises securing the bondside surface of the inner support layer to a wing of the aircraft.

32. A method as set forth in claim 16, wherein said securing step comprises cementing the bondside surface of the inner support layer to the surface of the aircraft.

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